POLLEVERYWHERE! EVEN IN THE CLASSROOM: AN INVESTIGATION INTO THE IMPACT OF USING POLLEVERYWHERE IN A LARGE-LECTURE CLASSROOM

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Abstract

Over the past several years, there has been a call in higher education to move from traditional lecturing to a more active classroom. However, many faculty members face multiple challenges when attempting to make a large lecture (over 100 students) an active learning environment[1]. One way researchers have suggested engaging a large lecture is through Concept Tests and Peer Instruction [2,3], which can require additional resources to be purchased by the students, such as electronic response systems or "clickers"[4-6]. This study will investigate the applicability of utilizing the free software PollEverywhere, which can be accessed using student cell phones (Text messages and Twitter) or personal laptop computers (www.pollev.com), as a potential method to improve student engagement by open-ended, reflective, multiple-choice, and content specific questions in a more efficient manner as perceived by students in a large-lecture classroom.

The purpose of this study is to investigate the impact of implementing polling software (PollEverywhere) on student engagement in an introductory computer science large lecture classroom (n = 291). The ease of use of this technology can help with the adoption of this active learning strategy. Research needs to be done to measure the impact of this software. During the fall semester of 2013, a pilot study was completed in an introductory computing course for non-computer science majors. During lecture, students were regularly asked to use the PollEverywhere software to respond to open-ended, reflective, multiple-choice, and content specific questions. At the end of the semester, students were asked to complete the survey to gauge if using the PollEverywhere software specifically changed their views of the course or about using response systems in the class.

The results were generally positive with many of the students stating they enjoyed using PollEverywhere and felt more engaged when PollEverywhere was used. More students felt more engaged with the open-ended questions than with multiple choice questions. Being able to ask open-ended questions is a benefit of using PollEverywhere over a traditional clicker system as well. The pilot study results uncovered a number of supportive elements for using PollEverywhere which will be investigated further in the next stage of the study.

Introduction

Over the past several years, there has been a call in higher education to move from traditional lecturing to a more active classroom[7-10]. However, many faculty members face multiple challenges when attempting to make a large lecture (over 100 students) an active learning environment [1]. Active learning can be defined as any teaching activity where students engage in the learning process[11]. One way researchers have suggested for integrating active learning into a large lecture classroom is through the use of classroom response systems, typically referred to as clickers (also called Personal Response Systems (PRS), Audience Response Systems (ARS), or Student Response Systems (SRS)[12-14]). Using response systems in the classroom has sparked the development of additional active learning techniques such as concept tests [1,10] and peer instruction [4,6,15].

However, technology is advancing quicker than it was even 10 years ago. With the advancement and wide-acceptance of technology by the general public and the everyday use of technology across generations, using a prescribed response system such as a "clicker" has become cumbersome and unneeded. Students bring technology (such as cell phones, tablets, or laptop computers) with them to each of their classes and there are a number of free online software tools that will allow instructors to utilize the students' own technology to better engage them in the course content. The purpose of this study is to investigate the impact of using such software on student engagement and attendance in a large introductory lecture course.

Literature Review

Clickers in the Classroom

As class sizes have grown over the last 50 years, instructors have searched for ways to engage students in the lecture. Hundreds of articles have been published on the use and applicability of using classroom response systems to do just that; article selections include multiple literature reviews[14,16,17] and across discipline examinations (business & accounting [7,9,12,18,19], chemistry[14], engineering[20-22], forestry[23], health sciences[24,25], life sciences[16,26], physics[3,4], and many others).

Overall, many studies show students feeling more engaged when clickers were used[7-9, 25,27,28]. However, some studies did find that even though students felt clickers were engaging, the researchers did not find any learning differences between students who use clickers and those who did not [9,18] with attendance [26,29] and highlighted the impact of quick feedback from students through the use of clickers [21,23,28].

A number of challenges are also highlighted within the literature [14,17,24]. One of the more common complaints about using a classroom response system is the high cost of each student purchasing a clicker [12,24,30] and the technological challenges associated with using the technology [30]. These challenges can be easily addressed through the Bring Your Own Device (BYOD) movement having students use free online software; both concepts are discussed next.

Beyond Clickers: Bring Your Own Device (BYOD)

Since the turn of the century, mobile devices have infiltrated daily life to the point that their use in everyday life is expected[31]. Examples of said integration of technology extend from making dinner reservations at a restaurant to completing in-class assignments both at the K-12 and higher education levels. The concept of using personal mobile devices in lieu of technology provided by a corporation or academic institution is coined the Bring Your Own Device (BYOD) or, more recently, Bring Your Own Technology (BYOT) movement [32]. The more traditional BYOD term will be used throughout this paper as we will be focusing specifically on devices over general technology utilization.

The literature indicates the BYOD movement is primarily witnessed within corporations rather than academic institutions due to the need for employers to address the 'millennial' generation entering full-time positions with the expectation of using their personal devices at will [33]. Some believe this paradigm shift is directly influenced by the 'millennial' generation taking their devices to school (from K-12 to higher education). Additionally, studies indicated a larger acceptance within this group of people for sharing information online and in largely social settings in real-time mode[32,34]. Findings support that the BYOD movement also has strong implications upon the future failure or success of IT departments within industry [35]. However, data collected during a recent Computacenter survey supports the idea that the BYOD movement is driven solely by corporate IT departments [33] and shrinking IT budgets [31]. Nevertheless, due to the enormity of mobile device utilization by all generations, studies indicate that the BYOD movement mirrors the inability of corporations and schools to enforce no-use policies of said devices [36]. If these implications are moving to the academic setting, then now there is the opportunity to maximize the BYOD trend to better engage students [37].

Motivation for learning fluctuates from person to person and the need to make the classroom more student-centered is premier and growing in importance [38]. Studies support the fact that educators now need to "reach the student's maximum learning potential by creating a customized education," (p. 35) [31]. Due to the influx of technology from the outside world in modern day classrooms, findings confirm that education is changing and educators are now able to take advantage of newer technology to change the lecture arena and "demand greater expectations of critical thinking skills and problem-solving" (p. 40) [31]. When 'flipping' the classroom in this nature, Miller, Voas, and Hurlburt believe educators have the ability to "transform passive learning into dynamic discovery" (p. 40) [31]. Research supports that students now gain knowledge quickly using their fingertips [31], whereas educators now provide the framework for how to learn. Thus, there is a secondary movement found in the literature where educators now use in-class sessions for application of knowledge rather than guiding an introductory discussion of the topic. Additionally, when examining BYOD research findings, data support the recapturing of student attention when students were otherwise distracted by personal devices since these devices are now being used in the classroom for learning [32]. Furthermore, student engagement data indicates a reconnection with the classroom via new learning communities created by the openness offered from using their own personal devices.

There are however setbacks to accepting the BYOD movement within a classroom setting. These discussions begin with the topic of security and end with the concern of how to protect student data. Malware, hackers, and the price of internet access are also high on the list of concerns [32,36]. Within industry, the issue of data protection of corporate data when employees leave an agency has also surfaced [36]. Nevertheless, these are all concerns when using any shared data condition or network implementation.

Research outcomes highly recommend that institutions implement BYOD policies. One such plan highly supported in the literature is known as the Williard Pyramid that describes the five main components for a full scale BYOD implementation [31,39]. BYOD plans correlate with a decreased institutional overhead and support green initiatives (p. 40) [31]. To be successful when using a BYOD plan, research also indicates that consistency of use is key [34,40,41]. Lastly, institutions need to buy into the idea that outside technology can be used effectively, without a severe learning curve, by the faculty who are managing these devices and applications to engage students [31].

Ackerman[31] confirms the lack of "quantifiable results in current BYOT pilots" (p. 40), thus, indicating the need for additional research in the BYOD field of inquiry to investigate newer technologies being used. Whereas, there is a large misconception of how effective newer BYOD devices can be in the classroom since marketing firms are inflating device possibilities or supported uses. Nevertheless, when students use their own devices, research indicates students are more involved in their learning and pedagogy supports a flipped classroom environment [38].

PollEverywhere

Bringing together the established pedagogical benefits of integrating clickers in the classroom with the emerging elements of the BYOD movement, this study utilizes the polling software PollEverywhere. This cloud-computing software has capabilities similar to those associated with clickers while allowing students to utilize personal devices to respond.

PollEverywhere allows instructors to ask open-response or multiple-choice questions of the class, who can respond using personal cell phones (Text messages and Twitter), tablets, or laptop computers (www.pollev.com). This software is relatively new, but has been casually discussed by a number of researchers in educational contexts [20,42-44]. However, PollEverywhere was not generally the focus of these studies, but was used within the courses setting of these studies or was highlighted as a potential tool to be used in the classroom or in future studies. We found no studies that investigated the pedagogical impact of using PollEverywhere and its impact on engagement. The purpose of the present study is to address this gap in the literature.

Methods

During the fall semester of 2013, a pilot study was conducted in an introductory computing course for non-computer science majors. The purpose of this study was to investigate the influence of PollEverywhere on student attendance and engagement with the course material in an introductory computer science large lecture classroom (n = 291).

PollEverywhere was used on a weekly basis within the lecture portion of the course. Examples of the polling questions include: (a) “What was the first product you purchased online?”[Open-ended], (b) “What year was the first email sent?” [Multiple choice], (c) “On a scale of 1 to 5 – how am I doing?” [Multiple choice], (d) “Have you registered for both our lecture and lab sections?” [Multiple choice], (e) “What is your definition of avionics?” [Reflective], (f) “What are your views of social media use in education?” [Open-ended/Reflective], and (g) “List descriptors for credible indicators of sources” [Open-ended].

Data Collection and Analysis

For this pilot study, a survey was used to gain student perceptions of PollEverywhere and its various elements. To increase our response rate, a paper copy was distributed during the last lecture, collected, and entered by hand into the computer. An electronic copy of the survey was also open in Survey Monkey for students who were not present in lecture to complete. An announcement was posted on the course learning management system and e-mailed to the students by the course instructor. A reminder e-mail was sent a week later and the survey was left open until the end of the semester (approximately 3 weeks later). A total of 79 responses were collected.

The survey contained two lists of items (one for students who regularly attended lecture and one for students who did not regularly attend lecture) and a short list of demographic items. The students were first asked if they regularly attended lecture and their responses filtered them to one list or the other with all students ending with the demographic items.

For students who attended lecture, survey items focused on: (a) the impact of PollEverywhere upon experiences in the classroom, and (b) the role of PollEverywhere on student attendance, enjoyment, and engagement. Two questions inquired about the most engaging types of PollEverywhere questions. Student thoughts were also examined with regard to working alone versus working with their peers. Other questions examined the logistical elements of using PollEverywhere, such as (a) what types of devices they used for answering, (b) how PollEverywhere compared to their previous experience with using other response systems (such as clickers), and (c) if they would like PollEverywhere to be used in other courses.

For students who did not attend lecture, an overview of the PollEverywhere application was provided in paragraph form, and students were asked if the instructor’s use of this tool would influence their lecture attendance.

A descriptive analysis was completed on this pilot data. Due to the limited number of responses from students who did not attend lecture (n = 14), statistical comparisons were not completed across the two groups. A Spearman Correlation was run across the items for students who attended lecture.

Sample and Context

The study focused around an introductory computer science course for non-computer science majors at a private institution in the southeast United States. Approximately 291 students were enrolled in the course during the fall of 2013 semester; our sample included 79 students; a response rate of 27%.

A majority of participants (n = 43 (54%); 12 participants Did Not Respond (DNR)) indicated they were completing their first year at the institution with 19% (n = 15) completing their second year. Over two-thirds of participants (n = 54 (68%); 12 participants DNR) were male and 70% (n = 55; 11 DNR) were between 17 and 23 years of age. English was the native language of 70% of participants (n = 55; 11 participants DNR).

Results and Discussion

The descriptive results provided will be displayed in two sections: (a) those who do not attend lecture, and (b) those who did attend lecture. Since this data was collected during a pilot study, the limited responses from students who did not attend lecture will not hinder this examination as the pilot is utilized to further uncover elements needed for additional examination. Phase two of this study is planned in the spring of 2014.

Did not attend lecture.

Of the 14 students who indicated they do not regularly attend lecture, four indicated they did not know the instructor was using PollEverywhere and that knowing this tool was being used would *not* have encouraged them to attend lecture. The remaining ten that did know the instructor was using PollEverywhere indicated that this was not a reason why they were not attending lecture. These results begin to indicate that while PollEverywhere is not attracting students to come to lecture, inversely it is also not causing them to stay away. Again, the pilot study numbers are very small and do not necessarily represent the large number of students who do not regularly attend lecture. However, these data do allow us to open the examination to include questions about lecture attendance in general to that of motivation that will be further explored in the next steps of this research.

Attended lecture.

For students who regularly attended lecture (n = 65), about 57% (n = 37; 4 participants DNR) of students affirmed (responded agree or strongly agree) that PollEverywhere use made them more likely to attend lecture. Students responded positively to PollEverywhere indicating that they (a) enjoyed class more (n = 54; 84%; 5 participants DNR), (b) felt more engaged (n = 53; 82%; 4 participants DNR), and (c) would like to see PollEverywhere used in other classes (n = 52; 81%; 5 participants DNR). These are generally positive results that begin to indicate when students attend lecture and participate in PollEverywhere polls, they were more engaged in the session.

When asked about the types of questions students preferred, students indicated they felt open-ended questions were more engaging (n = 38; 59%; 4 participants DNR) in comparison to multiple-choice questions (n = 18; 28%). Four students who completed the paper version of the survey at the end of the lecture session chose both of these responses. The higher preference of students for using open-ended questions highlights one of the primary benefits of using PollEverywhere over traditional clickers, which is that clicker types of systems only offer the opportunity for multiple-choice questions. The implications for the different types of questions must be more directly explored in the future study.

Student engagement findings were fairly split between the use of content related questions (n = 29; 45%; 9 participants DNR) to that of a reflective questioning approach (n = 24; 38%). Two students who completed the paper version of the survey during lecture chose both responses. Both types of questions were used in class but neither was overly preferred by a majority of the class. The benefits and engaging elements of each type of question will be further investigated in future studies.

Students also indicated they preferred to work alone (n = 30; 47%; 6 participants DNR) when responding to in-lecture questions. However, working in groups was the next preferred method (n = 22; 34%) in comparison to working in pairs (n = 7; 11%).

Regarding the BYOD aspect of PollEverywhere, Figure 1 shows the breakdown of devices students indicated using to answer polling questions. Students were asked to "check all that apply," which is why the numbers are higher than our total number of participants. Cell phones were the most popular device (n = 50), followed by laptops (n = 24), then iPads (n = 18). The two respondents that replied "Other" did not respond when asked for specific device(s) used.

Correlation Analysis

Significant positive correlations were found between various items. Students who enjoyed using PollEverywhere in class also felt more engaged ($p < 0.001$; $\rho = 0.697$); wanted to attend lecture more when PollEverywhere was going to be used ($p < 0.00$; $\rho = 0.535$); and wanted PollEverywhere to be used in other courses ($p < 0.001$; $\rho = 0.522$). Students who wanted to use PollEverywhere in other classes also felt more engaged when PollEverywhere was used ($p < 0.001$; $\rho = 0.553$). These results follow a logical train of thought where students who were engaged and enjoyed using PollEverywhere would like to continue using it elsewhere, where students who did not enjoy using PollEverywhere or who did not find PollEverywhere engaging, would prefer to discontinue their use altogether.

Two significant negative correlations ($\alpha = 0.010$) were also found. Students who had used other polling devices did *not* think PollEverywhere made class more enjoyable ($p = -0.340$; $\rho = 0.008$).

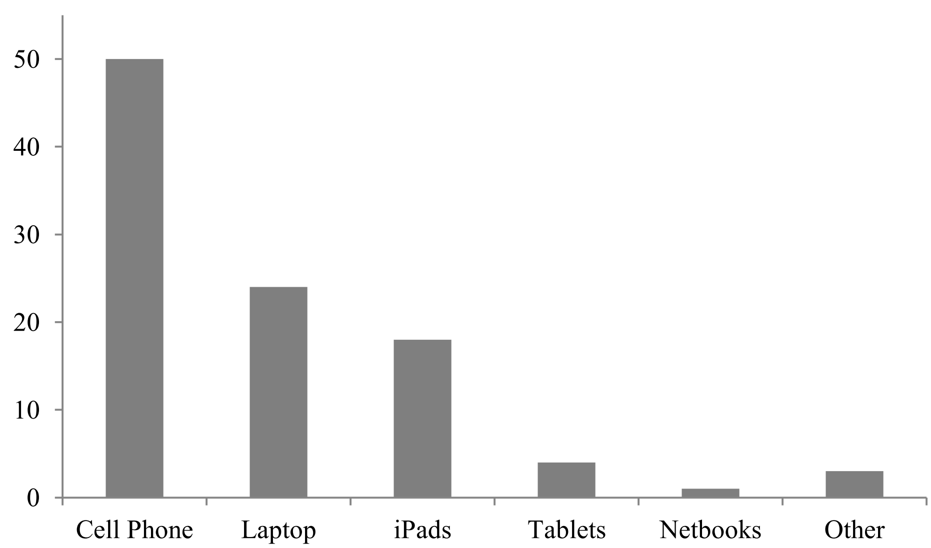

Figure 1: Distribution of devices students used to respond to PollEverywhere questions.

Students who had used other polling devices did *not* think they were more engaged while using PollEverywhere (p = -0.353; ρ = 0.006). This is an interesting finding as it indicates that students who had used other devices (such as clickers) did not think PollEverywhere made class more enjoyable and were not more engaged when PollEverywhere was used. This could be due to the "novelty factor" wearing off after using other polling devices. This result should be further explored in future studies.

Conclusion and Future Work

During this pilot study, we found a strong positive response to using PollEverywhere in a large introductory course. Where the use of this interactive pedagogy did not directly influence students who did not attend lecture to come to lecture, a number of students who attended lecture enjoyed using PollEverywhere and felt they were more engaged. However, there are some limitations to our pilot study. One limitation is a respondent bias; those who enjoyed using PollEverywhere may have been more likely to respond to our survey. In the next steps of our study we are hoping to have a number of check points throughout the semester to better gauge student engagement and interaction with PollEverywhere. We are also hoping that this might enable us to reach out to more students who do not regularly attend lecture and gain their perspectives as well. Based on our experience in the classroom during this study and the results found, we would recommend using PollEverywhere to other instructors who are looking to integrate a quick feedback or active learning element to their classroom, especially when considering how to better engage their audience. PollEverywhere offers additional features (such as asking open-ended questions or allowing students to submit questions during lecture) when compared to traditional classroom response systems while negating some of the limitations of clickers, such as purchasing costs (students already own a device).

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